(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 249 399 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
16.10.2002 Bulletin 2002/42

(51) Int Cl.[7]: **B65B 41/18**

(21) Application number: **01108932.3**

(22) Date of filing: **10.04.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant: **Tetra Laval Holdings & Finance S.A.**
1009 Pully (CH)

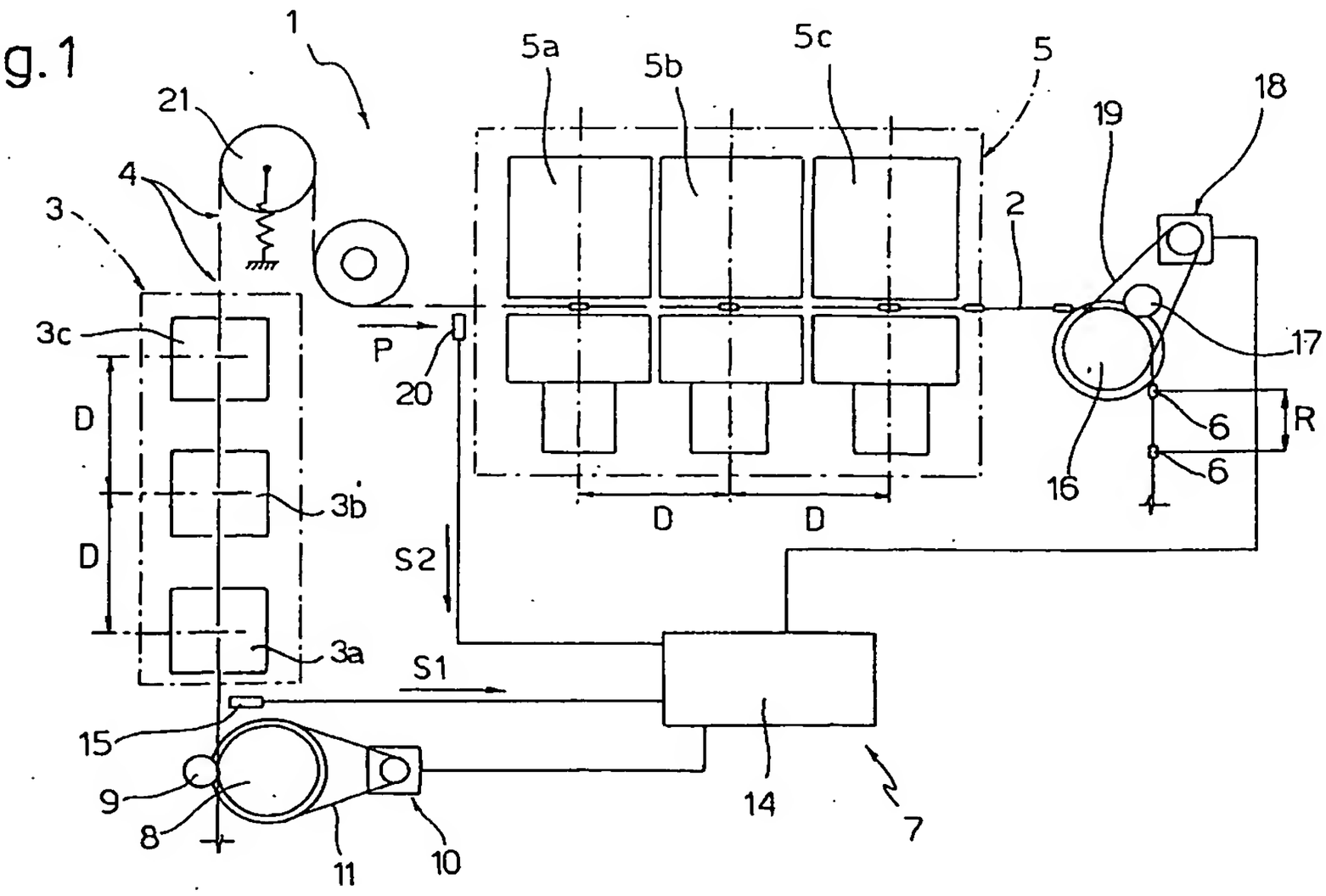
(72) Inventors:
- **Marbe, Peter**
  234 38 Lomma (SE)
- **Skörvald, Magnus**
  236 32 Höllviken (SE)

(74) Representative: **Cerbaro, Elena, Dr. et al**
STUDIO TORTA S.r.l.,
Via Viotti, 9
10121 Torino (IT)

(54) Unit for processing a web packaging material in a food product packaging machine, and method of indexing a web packaging material therein

(57) A unit (1) and method for processing a web packaging material (2) having features which periodically recur with a given repeatlength (R) in a machine for packaging food products, wherein the unit includes a first number (n) of processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) adapted to perform the same operation onto the web packaging material (2), in parallel, during each stop of the web packaging material (2) and spaced apart along a feed path (P) of the web packaging material (2) by a distance (D) which is equal to a second number (k) of repeatlengths greater than 1; the web packaging material (2) is step-fed according to repeated feed cycles constituted, each, by a number of feed steps equal to the second number (k), and in which the web packaging material (2) is advanced by a feed length equal to a number (L1, ..., Lk) of repeatlengths; the sum of the feed lengths of the feed steps constituting a feed cycle is equal to the first number (n) multiplied by the second number (k).

Fig.1



EP 1 249 399 A1

Description

[0001] The present invention relates to a unit for processing web packaging material in a food product packaging machine.

[0002] Many pourable food products, such as fruit juice, pasteurized or UHT (ultra-high-temperature processed) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0003] A typical example of such a package is the parallelepipedal package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is formed by folding and sealing laminated web packaging material. The laminated packaging material comprises layers of fibrous material, e.g. paper, covered on both sides with thermoplastic material, e.g. polyethylene. In the case of aseptic packages, the side of the packaging material eventually contacting the food product in the package also has a layer of barrier material, such as an aluminium sheet, which in turn is covered with a layer of thermoplastic material.

[0004] As is known, such packages are produced on fully automatic packaging machines, in which a continuous tube is formed from the web packaging material.

[0005] More particularly, the web of packaging material is sterilized, and then fed to a forming unit where it is longitudinally folded and sealed to form a tube. The tube is then filled with the sterilized or sterile-processed food product, and is sealed by pairs of jaws and then cut at equally spaced transverse bands to form pillow packs, which are subsequently folded mechanically to form the finished, e.g. parallelepipedal, packages.

[0006] Upstream from the forming unit, the web material may be fed through a processing unit where auxiliary operations are performed. For example, in case packages are to be made which are provided with opening devices, such as screw caps, hinge caps or pull-tabs, the aforesaid auxiliary operations may include a punching operation for providing holes at selected positions of the web, and the application of the opening devices onto the holes. Opening devices may applied by injection-moulding the opening device directly onto the holes, e.g. as described in WO 98/18608; as an alternative, opening devices may be bonded or thermowelded to the web packaging material.

[0007] In known machines, the web material is step-fed through the processing unit by an indexing system including feeding rollers driven by a servomotor which is controlled in response to a position signal generated by an optical sensor detecting a position index on the web, usually a printed pattern such as a bar code repeated along the web at a predetermined pitch which is equal to the length of the web portion that is necessary to manufacture a package, and therefore corresponds to the repeatlength of the packaging material design and to the pitch between holes.

[0008] The stop time of the web at the moulding station cannot be reduced below a give threshold, because plastics material must be allowed to cool down and solidify before the moulding tools are opened. In order to comply with this requirement but obtain, at the same time, a high production speed, known moulding stations for directly moulding opening devices on the web material generally includes a plurality of mould devices, typically three, which are spaced along the web feed path by a repeatlength distance and work in parallel, so as to mould a plurality of opening device during each stop of the web; at each feed step, the web packaging material is advanced by a number of repeatlengths equal to the number of moulding tools.

[0009] This arrangement is fully satisfactory when manufacturing relatively large packages, such as 1 litre packages, which have a repeatlength of about 180-200 mm or more, but cannot be used for smaller packages because the dimensions of the mould units cannot be reduced below certain limits. As a consequence, small packages, such as the so called "portion packages", usually lack a moulded opening device.

[0010] A scope of the present invention is to provide a unit for processing a web packaging material which is free from the aforesaid problems.

[0011] This scope is attained by a unit for processing a web packaging material in a machine for packaging food products, the web packaging material having features which periodically recur with a given repeatlength, the unit including feed control means for step-feeding said web packaging material along a feed path and at least a first number of processing devices spaced apart along said path and adapted to perform the same operation onto said web packaging material, in parallel, during each stop of said web packaging material, characterised in that said processing devices are spaced by a distance which is equal to a second number of repeatlengths greater than 1, said feed control means including means for step-feeding said web packaging material according to repeated feed cycles, each feed cycle being defined by a plurality of feed steps in which said web packaging material is advanced by a feed length equal to a number of repeatlengths which is less than said first number multiplied by said second number.

[0012] The invention also relates to a method of indexing a web packaging material in a web packaging material processing unit of a machine for packaging food products, the web packaging material having features which periodically recur with a given repeatlength, the processing unit including at least a first number of processing devices spaced along a feed path of said web packaging material by a distance which is equal to a second number of repeatlengths greater than 1 and adapted to perform the same operation onto said web packaging material, in parallel, during each stop of said web packaging material, said method including the step of feeding said web packaging material according to repeated feed cycles, each feed cycle being defined by a plurality of feed steps in which said web packaging material is advanced by a feed length equal to a number of

repeatlengths which is less than said first number multiplied by said second number.

[0013] Three preferred embodiments of the present invention are described hereunder, by way of non-restrictive example and with reference to the attached drawings, in which:

Figure 1 is a schematic side elevational view of a web packaging material processing unit according to a first embodiment of the present invention;
Figure 2 is a scheme showing successive steps of a method of indexing the web packaging material in the unit of figure 1 according to the present invention;
figure 3 is a scheme showing successive steps of a second method of indexing the web packaging material according to the present invention;
figure 4 is a scheme showing successive steps of a third method of indexing according to the ' present invention;
figure 5 is a scheme showing successive steps of a fourth method of indexing the web packaging material according to the present invention; and
figure 6 is a partial plan view of the web packaging material.

[0014] In figure 1, numeral 1 indicates, as a whole, a processing unit forming part of a packaging machine (not shown) in which a continuous tube is formed from a web 2 of packaging material. Web 2 is fed through unit 1 along a path P and is provided with a printed pattern or design conveniently including a bar code C (fig. 6), that periodically recurs with a pitch or repeatlength R corresponding to the length of packaging material which is used to produce a package.

[0015] Unit 1 includes a punch station 3 conveniently comprising a plurality of punch tools 3a, 3b, 3c spaced from each other along a first, vertical portion P1 of path P. In punch station 3, the packaging material web 2 is punched so as to produce equally spaced apertures or holes 4.

[0016] Unit 1 further includes a moulding station 5, including in turn a number of mould tools 5a, 5b, 5c equal to the number of punch tools 3a, 3b, 3c; in moulding station 5, located downstream of punch station 3 along a horizontal section P2 of path P, plastics material opening devices 6 are injection-moulded onto web 2 at holes 4 thereof. A plurality of, e.g. three, injection tools 5a, 5b, 5c are used, "in parallel" with one another, so as to allow web 2 to stop at moulding station 5 for a sufficiently long time to perform injection and obtain solidification of the plastics material, and still attain a high production rate.

[0017] Numeral 7 indicates as a whole an indexing system for step-feeding web 2 along unit 1.

[0018] The indexing system 7 includes a pair of infeed rollers 8,9 which cooperate with opposite sides of web 2 and are driven by a first servomotor 10. More particularly, servomotor 10 drives roller 8 by means of a first synchronous transmission 11, e.g. a toothed belt transmission; roller 9 presses web 2 against roller 8. Infeed rollers 8, 9 are located upstream from punch station 3 along web path P.

[0019] Servomotor 10 is controlled, so as to index web 2, by a control unit 14 which receives a first input signal S1 from an optical reader 15 located in the vicinity of the first punch tool 3a.

[0020] The indexing system 7 also includes a pair of outfeed rollers 16,17 located downstream of stations 3 along web path P. Outfeed rollers 16,17 cooperate with opposite sides of web 2 and are driven by a second servomotor 18; servomotor 18 drives roller 16 by means of a second synchronous transmission 19, e.g. a toothed belt transmission; roller 17 presses web 2 against roller 16. Servomotor 18 is controlled by control unit 14 which receives a second input signal S2 from an optical sensor 20 located in the vicinity of moulding station 5, e.g. immediately upstream of the first moulding tool 5a; conveniently, sensor 20 detects the position of holes 4 made by punch stations 3, and servomotor 18 is stopped by control unit 14 according to the reading of sensor 20 so as to precisely locate holes 4 inside respective mould cavities of moulding station 5.

[0021] Therefore, web 2 is independently indexed both at a first station, such as punch station 3, in response to the position of a first indexing code of web, i. e. the pre-printed bar code C, and at a second station such as moulding station 5, in response to the position of a second indexing code, e.g. holes 4, produced on web 2 at the punch station 3.

[0022] As a result of independent indexing of web 2 at infeed rollers 8,9 and outfeed rollers 16,17, differences may exist between web infeed and outfeed; such differences are taken up by a tensioner 21 interposed between punch station 3 and moulding station 5 along path P and schematically shown in figure 1. According to the present invention, punch tools 3a, 3b, 3c and mould tools 5a, 5b, 5c are spaced apart from one another by a distance D that is a multiple of, e.g. twice, the web repeatlength R.

[0023] The web feed is controlled according to repeated feed cycles including, each, a first feed step of a length equal to 5R, i.e. five times the web repeatlength R, and a second feed step of a length equal to the repeatlength R.

[0024] Figure 2 is a diagram showing the punching and moulding operations performed in the punching station 3 and in the moulding station 5 during some feed cycles after start up until a steady condition is reached. Holes 4 are indicated by "**X**", opening devices 6 by "**O**".

[0025] At start up, the two servomotors 10, 18 drive web 2 slowly until the bar code C is detected, then the servomotors 10, 18 are controlled so as to position web 2 in the right position for hole punching. The first three holes 4 are punched by punch tools 3a, 3b, 3c respectively, then web 2 is advanced by one repeatlength, i.e. is indexed by 1R, and a second series of three holes 4

is punched, thus forming with the first three holes 4 a continuous row of six holes. After that, web 2 is indexed by 5R, three holes 4 are punched, then web 2 is indexed by 1R and three holes 4 are punched. With the next 5R feed, the already punched portion of web 2 reaches moulding station 5, three more holes 4 are punched at punch station 3 and, simultaneously, three opening devices 6 are injected by respective mould tools 5a, 5b, 5c onto respective holes 4. Then web 2 is indexed by 1R, so that three holes 4 are punched and three further opening devices 6 are moulded at intermediate positions with respect to opening devices 6 already moulded.

[0026] The indexing method according to this embodiment of the invention includes, as explained above, a succession of feed cycles each made of a first feed step wherein web 2 is advanced by L1 = 5R and a second feed step wherein web 2 is advanced by L2 = 1R.

[0027] The feed cycle may be indefinitely repeated to produce, in steady conditions, an uninterrupted succession of opening devices 6 having a relative distance or pitch R equal to the repeatlength of the web packaging material 2.

[0028] Figure 3 is a diagram showing the punching and moulding operations performed in a punching station 3 including five punch tools 3a, 3b, 3c, 3d, 3e spaced by D=3R from one another and in a moulding station 5 having five mould tools 5a, 5b, 5c, 5d, 5e spaced by D=3R from one another, during some feed cycles after start up until a steady condition is reached. Again, holes 4 are indicated by "**X**", opening devices 6 by "**O**".

[0029] Start up is similar, mutatis mutandis, to the previous example; mould station 3 is activated immediately, whereas 5 is initially idle until it is reached by an already punched portion of web 2. At start up, the feed sequence is 1R, 1R, 13R, 1R, 1R, so that a continuous row of holes 4 spaced by one repeatlength is produced, with the first made hole 4 located one repeatlength (1R) before the first mould unit 5a (see line 6 of the diagram of fig. 3). By a following feed step of 13R the punched portion of web 2 is fed to the moulding station 5, with the first hole 4 of the row at mould tool 5e; five more holes 4 are made and, simultaneously, five opening device 6 are moulded. Two more 1R feed steps allow the feed cycle to be completed, thereby producing a continuous row of opening devices moulded onto respective holes 4.

[0030] The indexing method according to this second embodiment of the invention includes, as explained above, a succession of feed cycles each made of a first feed step wherein web 2 is advanced by L1 = 13R, a second feed step wherein web 2 is advanced by L2 = 1R and a third feed step wherein web 2 is advanced by L3 = 1R.

[0031] The feed cycle may be indefinitely repeated to produce, in steady conditions, an uninterrupted succession of opening devices 6 having a relative distance or pitch R equal to the repeatlength of the web packaging material 2.

[0032] Figure 4 shows diagrammatically a feed cycle of a moulding station 5 including three mould tools 5a, 5b, 5c spaced by D = 3R, i.e. three times the repeatlength R, according to another embodiment of the invention.

[0033] Punch unit 3 is not shown but must have the same tool number and spacing as moulding unit 5, as well as the same feed cycle as hereunder described.

[0034] As can clearly be seen by comparing the different lines of the diagram, a possible feed sequence is to advance the web packaging material by feed lengths of 2R, 2R, 5R; after three feed steps, the feed cycle is completed and, in steady conditions, all "the gaps" between previously moulded opening devices 6 are filled.

[0035] The expression "in steady conditions" is here used to take into account that, as is apparent from figures 5 and 6, more complex indexing patterns can produce some "gaps" at the beginning of production, so that the relevant packages must be disposed, but after a feed cycle the production reaches a steady state.

[0036] By comparing the feed cycles of figures 2, 3 and figure 4, it is to be noted that the number of feed steps that are necessary to "fill all the gaps" in steady conditions, i.e. the number of feed steps that constitute a feed cycle, is equal to the number k of repeatlengths that constitute the spacing between two successive punch or moulding tools. Another property is that the total feed length L of a complete cycle is 6R in the first case (5R + R), 15 R in the second case (13R + R + R) and 9R in the third case (2R + 2R + 5R), i.e. equal to the number n of tools (3, 5 and 3 respectively) multiplied by k as defined above (2 in the first case, 3 in the second and third cases). Finally, the last property to be considered is that the number L1, L2, ... Lk of repeatlengths corresponding to each individual feed step must not be divisible by number k as defined above, so as to avoid that two successive moulding operations are performed at the same web location.

[0037] These rules apply also to more complex sequences like, e.g., the one represented in figure 5, where again five moulding tools 5a, 5b, ... 5e (n=5) are used, spaced by three repeatlengths (k=3). The number of feed steps constituting a feed cycle is 3; the feed lengths L1, L2, L3 must not be a multiple of 3 and are linked by the following expression:

$$L1 + L2 + L3 = n*k = 15.$$

[0038] Another possible solution, besides the one described above with reference to figure 3, is L1 = 4; L2 = 7; L3 = 4. Other solutions are however possible.

[0039] The advantages of the present invention are clear from the foregoing description.

[0040] In particular, the indexing method according to the present invention allows the operating tools to be located with a relative spacing that is a multiple of the

web packaging material repeatlength; therefore, operations that require relatively large tools, such as moulding tools, can be performed by multiple tools acting in parallel also when producing small packages, i.e. when processing a web packaging material having a repeatlength R which is smaller than the minimum distance between tool centres allowed by the dimension of the tools.

[0041] Clearly, changes may be made to unit 1 as described herein without, however, departing from the scope of the present invention as claimed.

[0042] In particular, the indexing method of the invention can be applied to only one or more than two operating stations, and the processing operation performed may be different; in particular, a processing operation may consist of the application of a pull tab.

Claims

1. A unit (1) for processing a web packaging material (2) in a machine for packaging food products, the web packaging material (2) having features which periodically recur with a given repeatlength (R), the unit including feed control means (14, 10, 18) for step-feeding said web packaging material (2) along a feed path (P) and at least a first number (n) of processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) spaced apart along said path and adapted to perform the same operation onto said web packaging material (2), in parallel, during each stop of said web packaging material (2), **characterised in that** said processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) are spaced by a distance (D) which is equal to a second number (k) of repeatlengths greater than 1, said feed control means (14, 10, 18) including means (14, 10, 18) for step-feeding said web packaging material (2) according to repeated feed cycles, each feed cycle being defined by a plurality of feed steps in which said web packaging material (2) is advanced by a feed length equal to a number (L1, ..., Lk) of repeatlengths which is less than said first number (n) multiplied by said second number (k).

2. A unit as claimed in claim 1, **characterised in that** the sum of said feed lengths (L1, ..., Lk) of said feed steps constituting a feed cycle is equal to said first number (n) multiplied by said second number (k).

3. A unit as claimed in claim 1 or 2, **characterised in that** the number of feed steps defining each feed cycle is equal to said second number (k).

4. A unit as claimed in any of the preceding claims, **characterised in that** the number of repeatlengths (L1, ..., Lk) defining the feed length of each feed step is not divisible by said second number (k) .

5. A unit as claimed in any of the foregoing claims, **characterised in that** said processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) include mould tools (5a, 5b, 5c, 5d, 5e) for moulding opening devices (6) onto said web packaging material (2).

6. A unit as claimed in any of the foregoing claims, **characterised in that** said processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) include punch tools (3a, 3b, 3c, 3d, 3e) for providing holes (4) in said web packaging material (2).

7. A unit as claimed in any of the foregoing claims including three processing units (3a, 3b, 3c; 5a, 5b, 5c) spaced by two repeatlengths from one another, **characterised in that** said feed cycle includes a first feed step of five repeatlengths and a second feed step of one repeatlength.

8. A method of indexing a web packaging material (2) in a web packaging material processing unit of a machine for packaging food products, the web packaging material (2) having features which periodically recur with a given repeatlength (R), the processing unit including at least a first number (n) of processing devices (3a, 3b, 3c, 3d, 3e; 5a, 5b, 5c, 5d, 5e) spaced along a feed path (P) of said web packaging material (2) by a distance (D) which is equal to a second number (k) of repeatlengths greater than 1 and adapted to perform the same operation onto said web packaging material (2), in parallel, during each stop of said web packaging material (2), said method including the step of feeding said web packaging material (2) according to repeated feed cycles, each feed cycle being defined by a plurality of feed steps in which said web packaging material (2) is advanced by a feed length equal to a number of repeatlengths (L1, ..., Lk) which is less than said first number (n) multiplied by said second number (k) .

9. A unit as claimed in claim 8, **characterised in that** the sum of said feed lengths of said feed steps constituting a feed cycle is equal to said first number (n) multiplied by said second number (k).

10. A unit as claimed in claim 8 or 9, **characterised in that** the number of feed steps defining each feed cycle is equal to said second number (k).

11. A unit as claimed in any of the preceding claims from 8 to 10, **characterised in that** the number of repeatlengths (L1, ..., Lk) defining the feed length of each feed step is not divisible by said second number (k) .

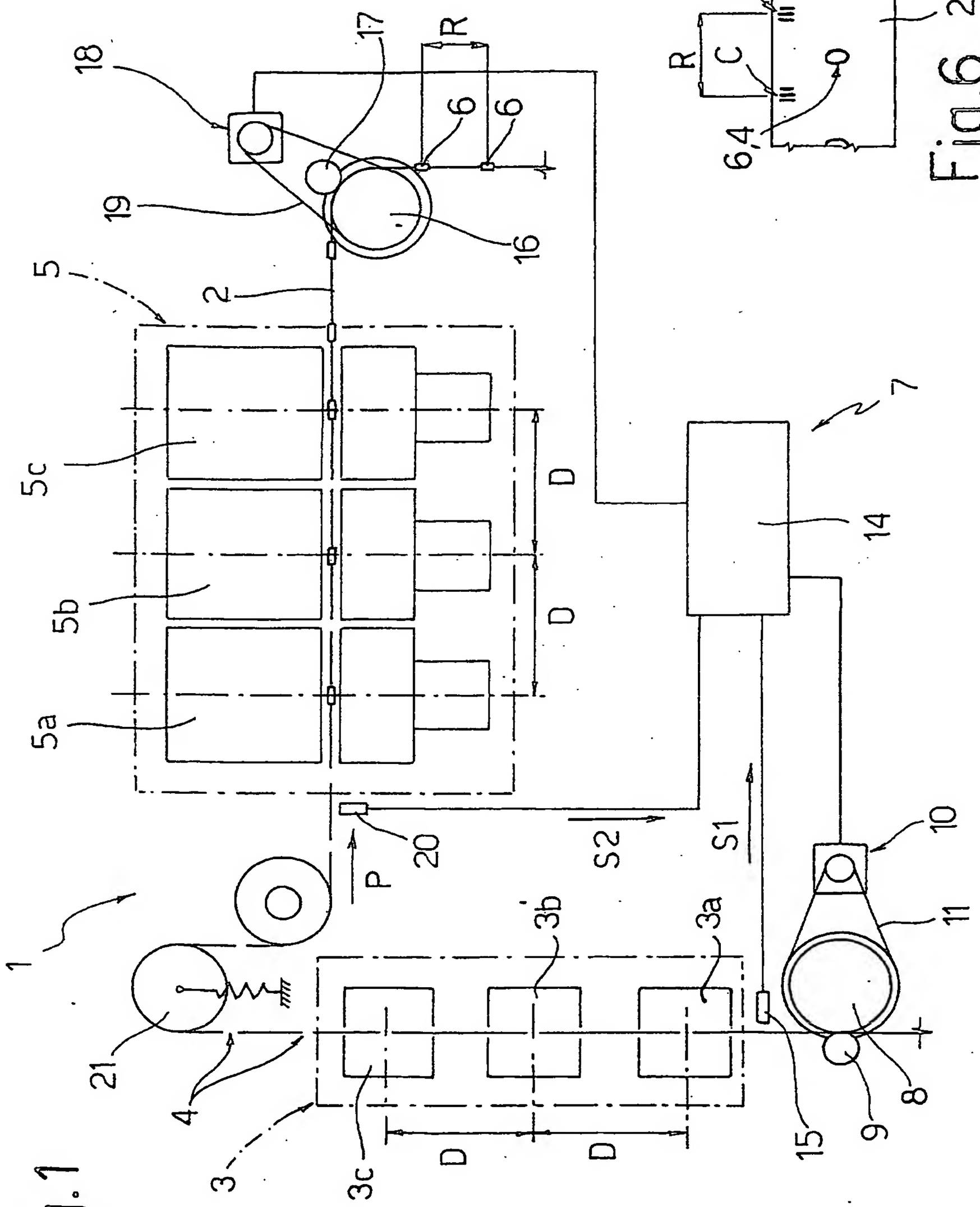

18
17
R
6
6
19
16
5
2
5c
5b
5a
D
D
7
14
10
11
S1
S2
P
20
1
21
4
3
3c
3b
3a
D
D
15
9
8

Fig.1

64
C
R
C
64
2

Fig.6

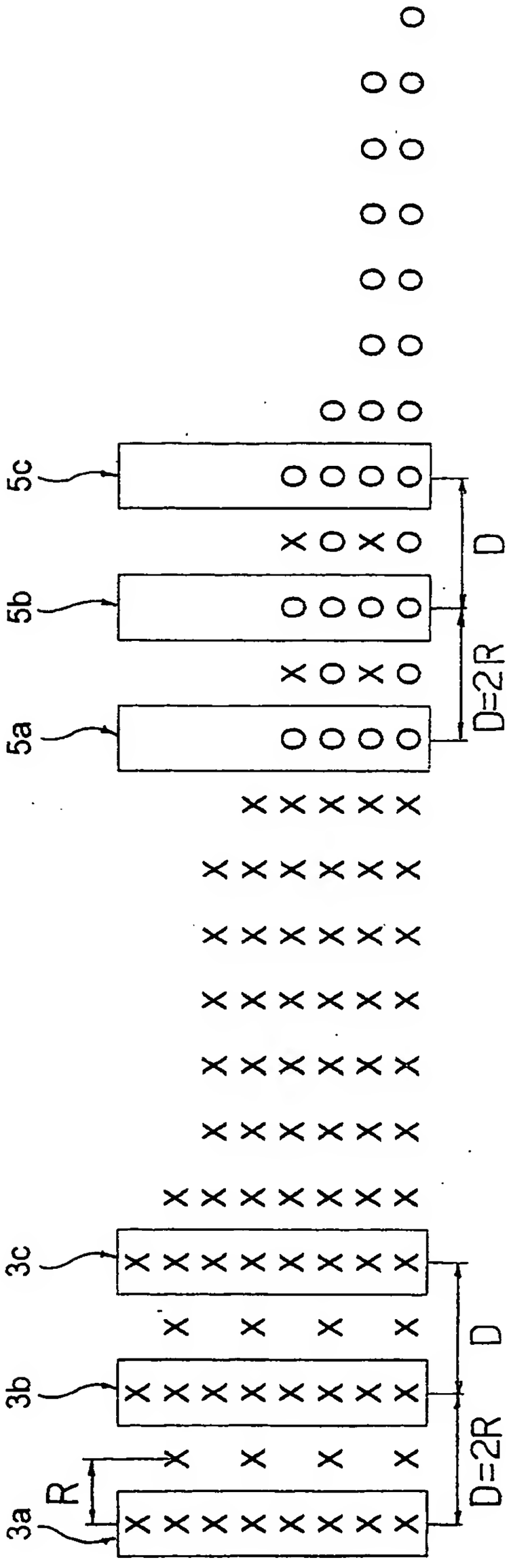

5c
5b
5a
D
D=2R

Fig.2

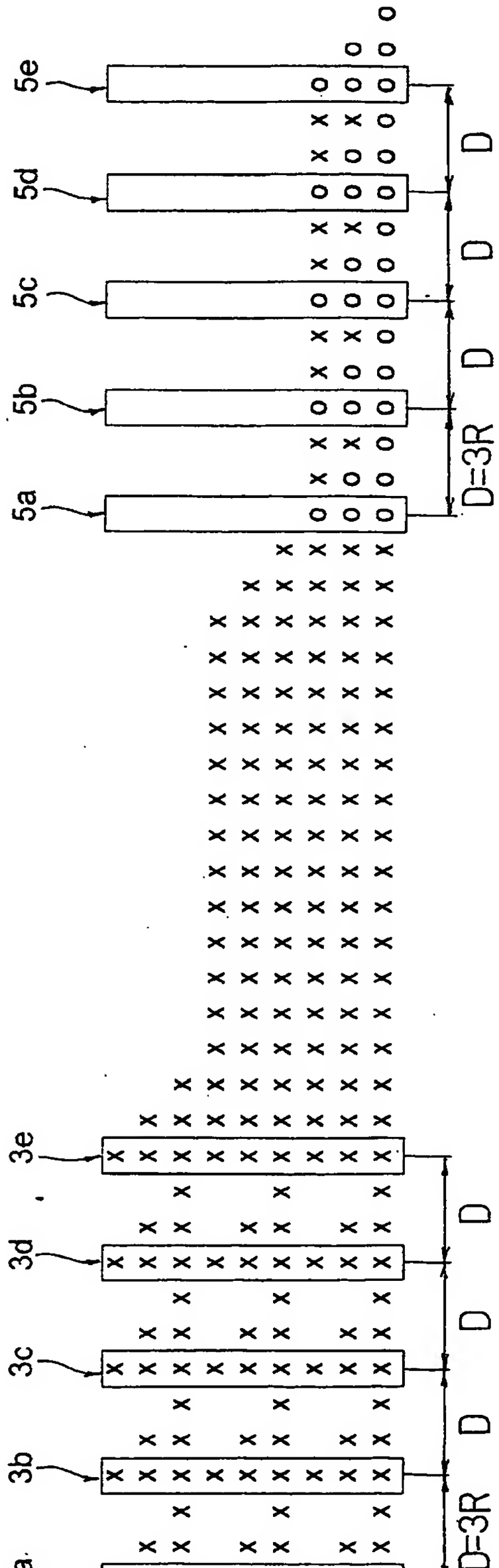

5e
5d
5c
5b
5a
D
D
D
D=3R

Fig.3

3c
3b
3a
R
D
D=2R
START
→R
→5R
→R
→5R
→R
→5R
→R

3e
3d
3c
3b
3a
D
D
D
D=3R
START
→R
→R
→13R
→R
→R
→13R
→R
→R

Fig.4

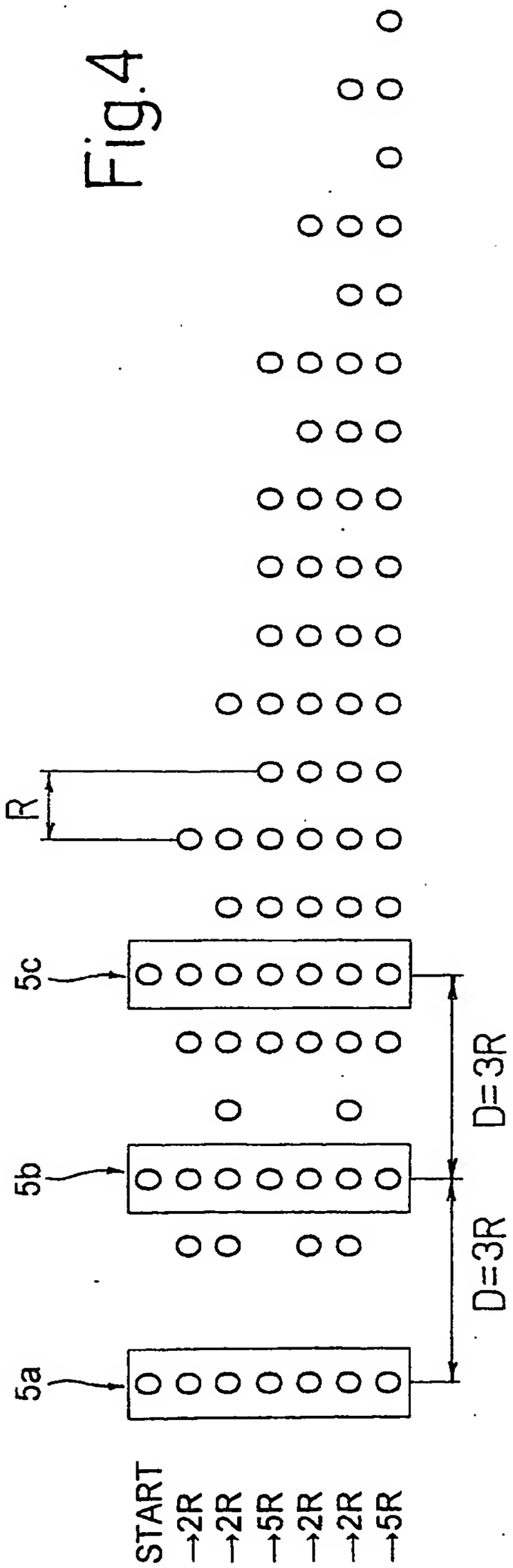
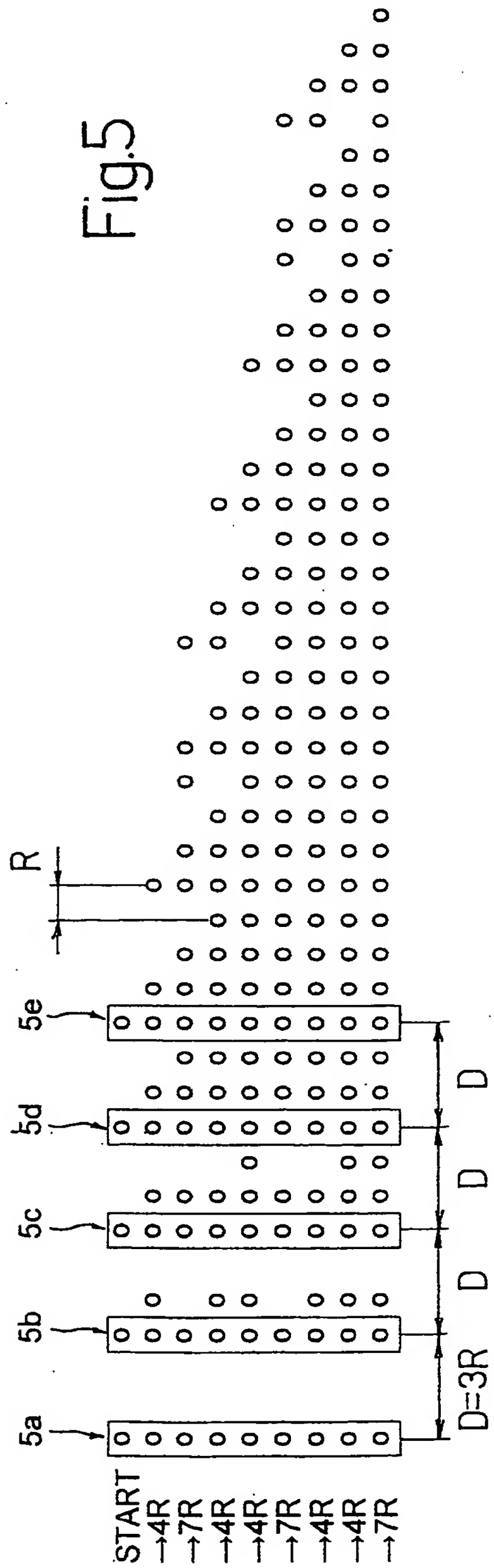

R
5c
5b
5a
D=3R
D=3R
START
→2R
→2R
→5R
→2R
→2R
→5R

Fig.5


R
5e
5d
5c
5b
5a
D
D
D
D=3R
START
→4R
→7R
→4R
→4R
→7R
→4R
→4R
→7R

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 8932

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,A	WO 98 18608 A (TETRA LAVAL) 7 May 1998 (1998-05-07) * page 7, line 10-34; figure 1 *	1,8	B65B41/18

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 September 2001	Grentzius, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 10 8932

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-09-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9818608 A	07-05-1998	IT MI962272 A	30-04-1998
		AU 720593 B	08-06-2000
		AU 4407897 A	22-05-1998
		BR 9712608 A	26-10-1999
		EP 0949992 A	20-10-1999
		FI 990978 A	29-04-1999
		HU 9904349 A	28-05-2000
		JP 2001503344 T	13-03-2001
		NO 992117 A	30-04-1999
		PL 333205 A	22-11-1999
		TR 9900932 T	23-08-1999